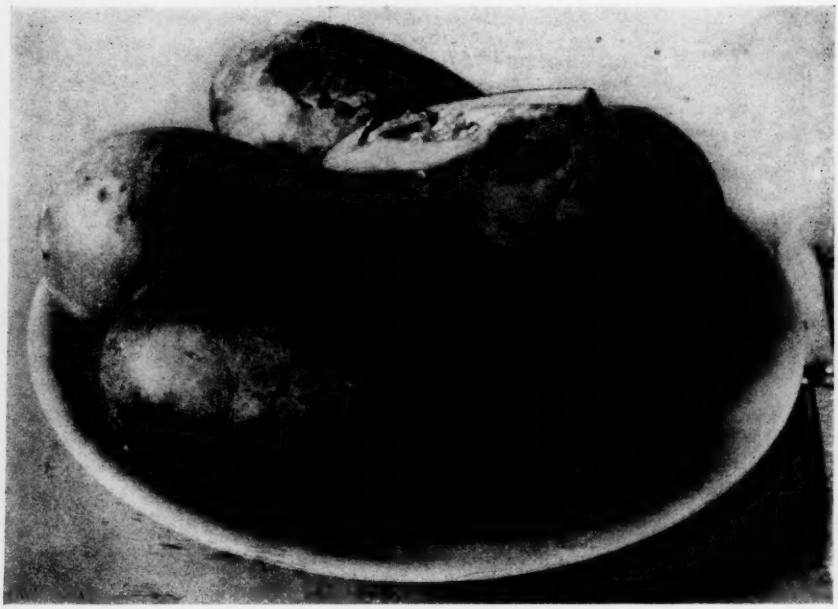
The Journal of HEREDITY



ACE PLANT CINDERELLA
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The I. Q. Battle Up to Date

Genetics and the Physician

Genetic and Cultural Inheritance

Population Quality and National Defense

Associated Defects of Short-Ear Gene in Mice

VOLUME 32 MARCH, 1941 NUMBER 3

The American Genetic Association

An incorporated organization devoted to promoting a knowledge of the laws of heredity and their application to the improvement of plants, animals, and human racial stocks

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The

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The **Journal** has obvious advantages as a supplementary text in genetics classes. Since genetics deals mainly with form and pattern differences in organisms the **Journal** offers an unexcelled introduction to current developments, which have an added interest and appeal on account of the large number of illustrations published.

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THE LARGEST NORTH AMERICAN FRUIT

Frontispiece

The American papaw (*Asimina triloba*) is the largest native fruit found in North America. It has only been casually utilized, and has remained unimproved by hybridization and selection prior to the experiments reported herewith. This is remarkable because the fruit is liked by many people, and the plant is inviting to the plant breeder, showing great variation in size, flavor, ripening time of the fruit. The papaw is a relative of a tropical genus which has pushed into temperate regions. The fruit has a flavor somewhat resembling its tropical relatives, the custard apple and the sweetsop.

HYBRIDS OF THE AMERICAN PAPAW

G. A. ZIMMERMAN
Harrisburg, Pennsylvania

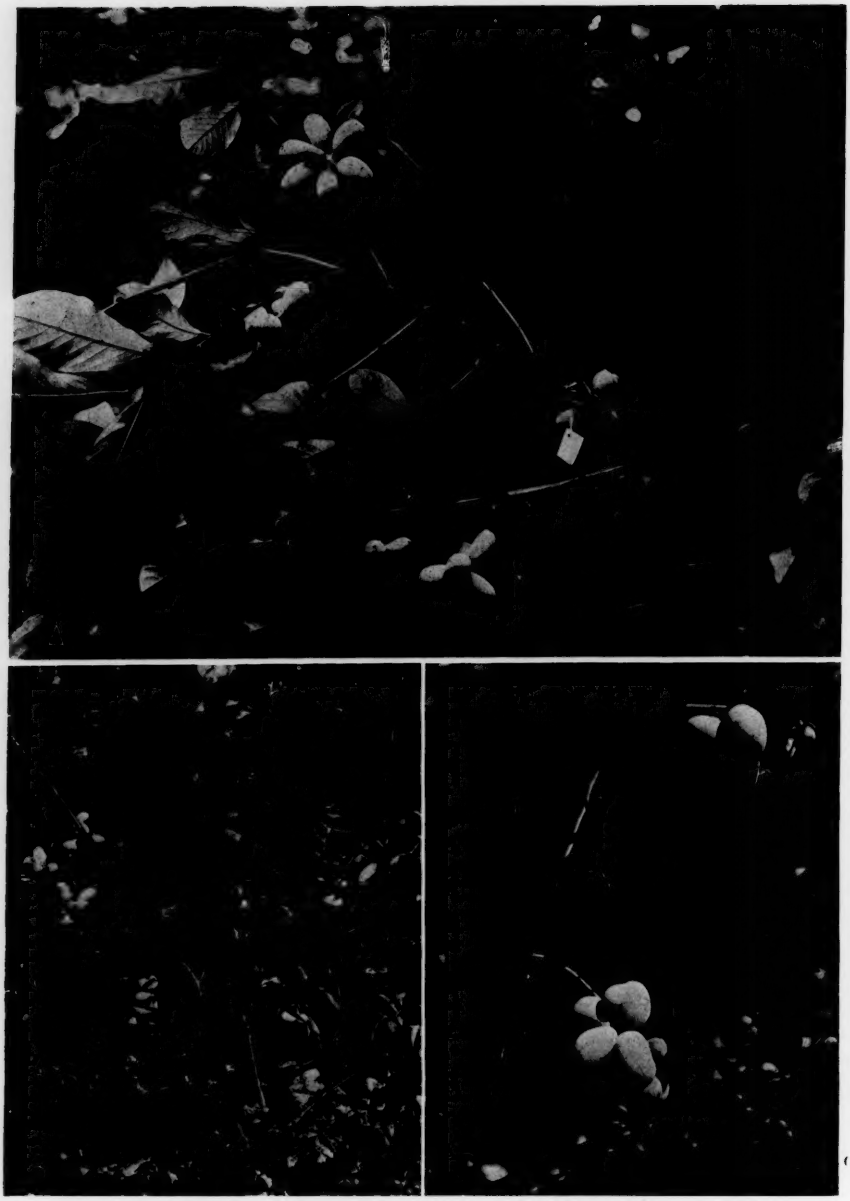
THE American papaw continues to be an horticultural orphan. The virtues of this interesting plant were called to the attention of plant lovers in a contest sponsored by this Association in 1916 to find the largest papaw, tree and fruit, growing in the United States. In that contest this largest wild fruit in North America did fairly well, for the winning papaw weighed twelve ounces, and was of delicious flavor. Reliable accounts of fruits a third heavier than this were reported. The plant grows over the entire eastern United States, except New England and Florida, and its culture is not difficult. In spite of these rather challenging possibilities it continues to be ignored.

The experiments in hybridization and selection of the papaw here reported appear to be one of the few projects which trace to the Association's contest of a quarter century ago. The results obtained to date suggest that this botanical Cinderella is quite capable of blossoming into a princess of our gardens with very little attention on the part of horticulturists.

Botanically, the papaw is somewhat of an anomaly. First of all, it is no relative of the tropical papaya (*Carica papaya*) which is also sometimes called "papaw". Among its relatives are to be found some of the outstanding tropical fruits of the world, — the Annonas which include the cherimoya, the custard apple, the sweetsop and the Javanese keppel. The genus *Asimina* to which the papaw belongs is a temporate zone representative of a tropical group. The nine or ten other species of the *Asiminas* are not promising fruit bearers of themselves, but as reported below they do offer excellent possibilities for hybridization with the papaw.

Through the encouragement of Dr. David Fairchild the writer has continued his interest in the papaw ever since the contest in 1916 brought the plant to his attention. In the intervening years he has gathered at his home at Piketown, Pa., all of the recognized varieties and many unnamed selections. Together with seedlings of the best ones, his collection comprises probably sixty or seventy varieties in all. Many of these selections are for breeding purposes only. In fact the ultimate goal of this venture is the production of hybrids between the *Asiminas* and the *Annonas*. This collection has been derived from an area extending from Ontario to Florida and from California to Massachusetts. (The plants from California, however, I believe were introduced there from the Central West.) The best types have come from the river bottoms of the Susquehanna, the Potomac and the Ohio. One of them, the Fairchild, a seedling of the papaw that took first prize is still, I consider, the best. The Ketter, the first prize winner, is a close second. I might just add here that for many years the Ketter produced very poor fruit when grafted on native wild stock but in recent years since the top has had time to overcome the root system the fruit is showing up as the delicious product it really is. This collection is large enough to furnish ample variations for the breeding work which has been begun. The pleasing and valuable qualities of some of these fruits have far exceeded expectation. The collection includes not only the papaw itself, *A. triloba*, but nine other species of *Asimina* or their hybrids, from Florida or Georgia. These are of value for crossing because they bring with them the fragrance so lacking in the *triloba*, a touch of delicate flavor to the fruit and the beauty of gorgeous flowers not met with in the north.

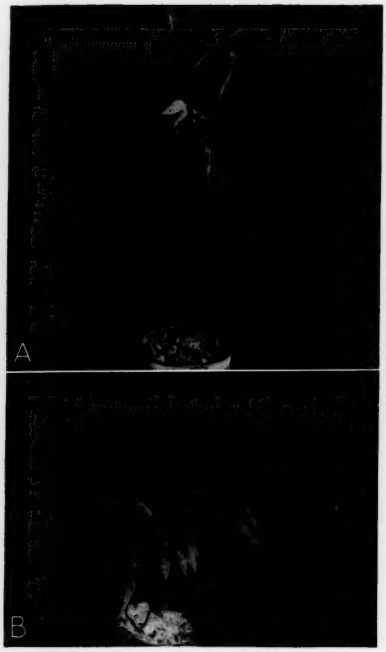
There is a wide variation in the fruit of the *triloba* but it will suffice to divide them into two classes: a large, yellow fleshed, highly flavored, early ripening type; and a white fleshed, mild flavored, late or very late ripening fruit. These are variable in size: some are very large. The



HYBRID TREES PRODUCE ABUNDANT FRUIT

Figure 1

Three "trilobovata" hybrids (*triloba* × *obovata*) growing at Pikestown, Pa. Like the native papaw, these produce fruit if hand pollinated but otherwise very few fruits develop. *A*—shows a branch which was hand pollinated with its own pollen. *B*—is a small tree hand pollinated with Taylor papaw pollen and *C* shows two limbs of a hybrid tree hand pollinated with its own pollen.



PARENT AND HYBRID
Figure 2

A—a small plant of *A. angustifolia*. This bore three flowers, which were pollinated with *tetramerus* pollen. Three fruits set; two fell off and one matured, having two seeds. These have germinated and are now growing. *B*—is a "Trigustifolia" hybrid (between *angustifolia* and *triloba*). This hybrid has proven hardy at Pikestown, Pennsylvania, though this speciman was grown in the greenhouse.

light fleshed varieties are as a rule a little too mild in flavor, while some of the yellow fleshed fruits are too highly flavored. Some of them are really delicious while others are fit only for the hogs who are not quite so fastidious. The selected varieties have rather large fruit and mild, delicious flavor. Eaten with cream and graham wafers they make a delightful breakfast dish. They are also excellent in pies. Their food value is largely in carbohydrates. They are reputed to have medicinal value, but this is negligible if any at all. They are also reputed to make some people sick but this may be due to personal idiosyncracies, just as in the case with strawberries and tomatoes.

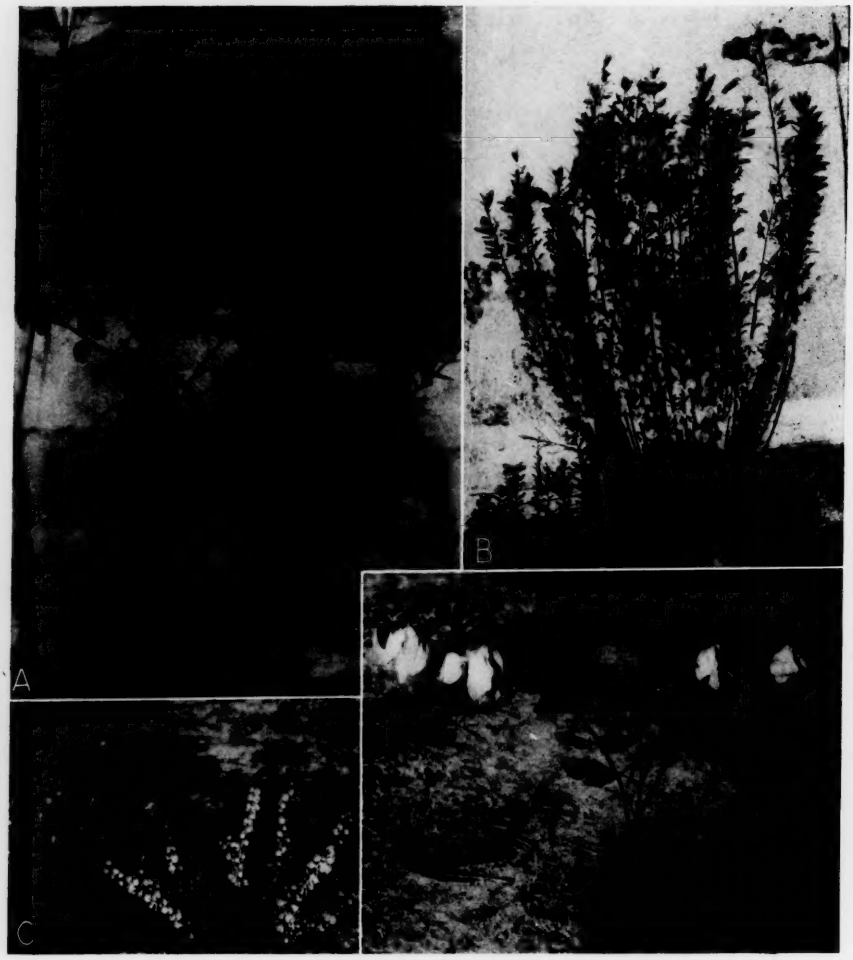
Further interesting discussions on *Asimina triloba* will be found in this JOURNAL for July 1916 and January 1917.

Varieties

The varieties of today will probably be replaced by other and better ones. But a few that deserve note at this time are: (early varieties) Fairchild, Ketter, Hope's August; (later and very late varieties) Gable, Taylor, Tiedke, Jumbo, Shannondale, Osborne, Buckman, and Martin. Martin, although rather small and not of very good flavor, is interesting in that it seems able to resist cold better than any other I have seen. Contrary to popular belief, papaw fruit will not stand low temperatures. A cold wind for a few days with temperature under fifty will turn the fruit black and spoil its flavor. This is not surprising considering the tropical relationship of the papaw.

Propagation

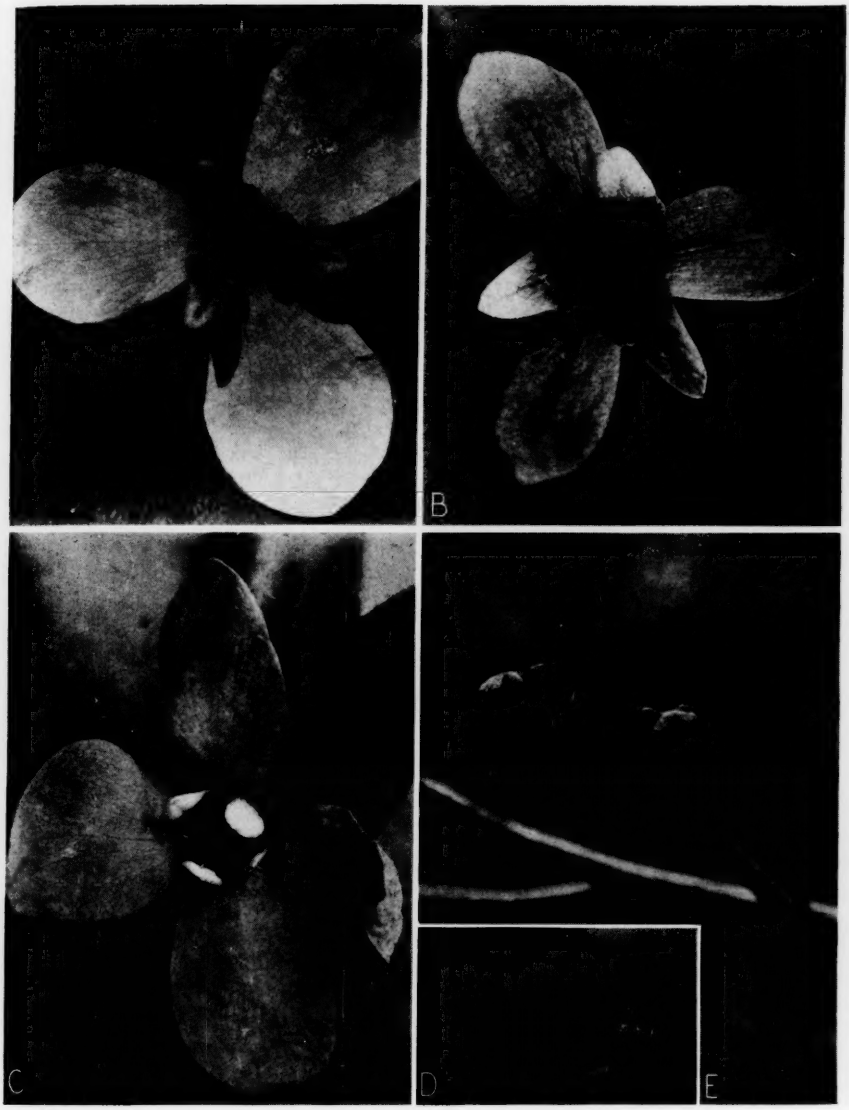
Contrary also to popular belief, propagation is easy. Papaws graft very readily on any native stock. Any of the methods used in nut culture are satisfactory, and the scions make excellent growth. They must, however, be grafted a little earlier than persimmons or hickories. In the latitude of Harrisburg, Pa., any time in April or early May is best. Seeds of selected *Asiminas* will give a large percentage of trees bearing excellent fruit. I have been able to handle seed best by placing them in moist sand in a can immediately after collecting, closing the can and placing in a cellar or cave. About February they begin to sprout. As the weather gets warm enough the sprouted seed can be picked out and planted, either in their permanent places, or in nursery rows a foot apart to be transplanted later when they are about a foot high. Larger plants transplant with considerable difficulty. A stake should be driven and a little shade afforded them for a year or two. The sprouted seed will grow about six inches the first year, a little more the second and after that quite



PAPAW RELATIVES AND A HYBRID

Figure 3

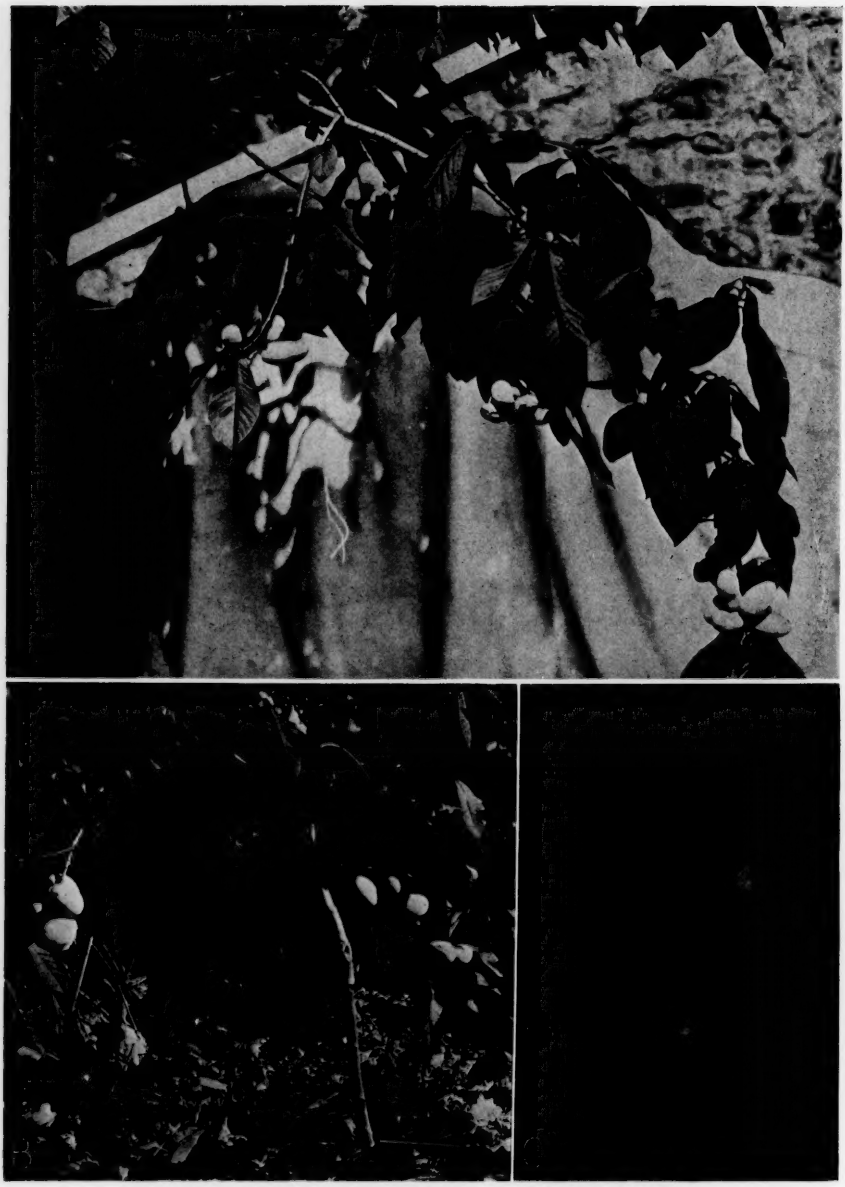
A—Plant of the "trilobovata" hybrid in flower. The flowers when fully opened are slightly over three inches in diameter. The plant is growing at Pikestown, Pennsylvania, and is fully hardy. *B-C*—Plants of *Asimina reticulata* in flower in eastern Florida. The large fragrant flowers are more than three inches across. Photograph by Dr. Buswell. *C*—shows small plants of *reticulata* covered with blooms. This shrub is found growing over most of the state. The flowers of *A. obovata* (*D*) are six inches in diameter. This Florida species has the largest flowers of any member of the genus.



FLOWERS OF ASIMINA SPECIES

Figure 4

A—The large flower of *incana* (*speciosa*). This species occurs in two varieties, one with pink petals, and the other with white petals tinged with yellow, of a heavier structure. *B*—the flowers of some plants of *reticulata* are fragrant as well as showy. *C*—The largest-flowered species of the genus, *obovata*, has flowers as much as six inches across. Nearest relative of the papaw, parviflora (*D*), has a small foul-smelling flower. The papaw itself has an inconspicuous inflorescence (*E*) shown here somewhat enlarged. (Photograph courtesy of the U. S. Department of Agriculture.)



HAND POLLINATION NECESSARY TO PRODUCE FRUIT

Figure 5

In the large orchard of papaw trees at Pikestown, Pa., very few fruits are produced unless the flowers are pollinated by hand. This illustration shows details of three trees which have produced abundant fruit as the result of hand pollination. *A*—is a Taylor tree hand pollinated with Taylor pollen. In the ten preceding years not a half dozen fruits have been borne on this tree unless it is artificially pollinated. The small tree (*B*) has abundant fruit on three branches as a result of hand pollination. No fruit appears on the rest of the tree. A limb of the Shannondale papaw (*C*) heavily covered with fruit as a result of hand pollination. Here again no fruit was borne on the rest of the tree.

rapidly, depending of course on the fertility of the soil and the water supply. Moist but not wet ground is best. Seedlings from good seed are desirable, for papaws are usually rather short lived. Thus they are inclined to die back every now and then and if the trees are seedlings the stumps will soon sprout and make nice trees again. But with grafted trees the varieties would be lost and the trees have to be regrafted. They should be pruned a little from time to time to force new bearing wood. I have had very little experience with fertilizers but it appears that some lime in acid soil districts improves the trees.

Allied Species and Hybrids

According to Small there are ten species of *Asimina: triloba, parviflora, obovata, tetramerus, incana* (*speciosa*), *angustifolia, reticulata, pygmaea, pulchellus* and *rugleii*. The last two are said to have very fragrant flowers. Some plants of the *reticulata* also have fragrant flowers. Since the death of Small many botanists have either questioned or denied the existence of *tetramerus* as a species. However there is a beautiful plant found in abundance along the east coast of Florida, north and south of West Palm Beach that does not quite fit into any other classification. If I were to cross the *obovata* with the *reticulata* I would expect just such plants to result. I am therefore inclined to think they are hybrids. Be that as it may, nature might have made a worse combination for breeding purposes. Photographs of some of these handsome plants and flowers are shown herewith.

My first experience with hybrids came several years ago when I brought with me from Florida pollen of the large flowered *obovata,* storing it for six weeks with calcium chloride. When the papaws came into bloom I successfully pollinated the flowers of Hope's August with this stored *obovata* pollen. This produced the *trilobovata* (Deming). These plants have been perfectly hardy and have fruited every year when I have taken the time to hand pollinate them. Unless this is done they set only an occasional chance fruit. This hybrid is rather too highly flavored for my taste, but many people like it. Other crosses made since then with the mild flavored, white fleshed Buckman have tamed down the flavor. The hybrids have been crossed with several other varieties, and fertilized with their own pollen, but the resulting plants are too small for bearing as yet. As a matter of fact all seeds produced are hybrids because I necessarily make crosses when I hand pollinate the flowers to get them to set fruit.

A second cross between the *angustifolia* and *triloba,* producing the *trigustifolia* is making excellent growth. These hybrids are interesting because the male parent, *angustifolia,* has leaves not over a half inch wide and six or seven inches long. The hybrid is much like *angustifolia* in shape of leaf, but it has not yet flowered. It has been hardy so far.

Crosses were made last spring between *incana* and *triloba* and also between the *reticulata* and *triloba.* The seed of these will be planted this spring.

Other hybrids, mostly between the better *trilobas,* are under way and ought to produce some excellent fruit within a year or so. It is interesting to note that by cutting the tops from the hybrid seedlings at the end of the first year and grafting them into large plants it is possible to get a huge growth which often sets flowers the next year. These produce fruit if they are hand pollinated. Cutting off the tops does not hurt the little plants in the least. The grafting is a chore but when a man is getting old it enables him to see the results of his work, perhaps before he passes out. It is expected that these hybrids will form a sort of "half way station" in crossings with the *Annona.*

Hand Pollination Necessary

It is becoming quite clear that if we want fruit in any considerable quantity from our finer varieties of papaws we must resort to hand pollination. Dr. Fairchild informs me that in Egypt *Annonas* are hand pollinated on a commercial scale. This is a tedious job, but there seems to be no way to avoid it at pres-

ent. I have many trees of fine varieties of *triloba* that have never yet set a fruit unless they were hand pollinated, even though they were covered with bloom. This is a poor showing when compared with the limbs shown in Figure 5 from these very same trees covered with fruit so heavily that they are bent to the ground. Some limbs have broken off from weight of fruit and yet not a single fruit set on any other part of the tree. It seems to make little difference what papaw pollen is used provided it is good and the flowers are pollinated early enough. Ordinarily all the early bloom drops off. The later bloom of some trees will set an occasional fruit. Many trees have never set any fruit as long as I have had them under observation, while a few others bear fairly and rather regularly. Once in a while a tree bearing good fruit has this desirable habit. The Fairchild is notable in this respect although it never bears the quantity of fruit it should.

The principal reason for this unfortunate infertility is that the flowers of *triloba* are nearly always dichogamous, with the stigma maturing frequently a long time before the anthers shed their pollen (protogynous). In view of the fact that nearly all of the flowers display this cycle of maturity one can easily see why the early opening flowers set no fruit. The late flowers occasionally get pollinated if an insect or the wind happens to convey the necessary pollen from another flower. This is not at all a frequent occurrence with the *triloba* for its bloom is inconspicuous and almost foul scented.

I doubt whether the wind is an important factor in the pollination of the papaw, and insects in the north are little more valuable. I have never yet seen an insect in the flowers of the *triloba* that appeared to have anything to do with pollinating it. In the south, on the large flowered *obovata* I have often observed a beetle of the *Trichius* group go into the flower and get caught under the petals, which evidently scared him. He would set up quite a whirlwind in the flower and escape covered with pollen, go to another flower, crawl in and do the same thing. In some years hardly a flower of the *obovata* escapes such treatment. Even though the flowers of the papaw are perfect, they are nearly always dichogamous, so without the aid of the wind or of insects, it seems that to plant different varieties together in the hope of better pollination is not likely to be very helpful.

Our only hope seems to lie in our ability to find special trees which will pollinate their own flowers and bear good fruit. Such plants can perhaps be produced through hybridization and selection. The only other solution seems to be to resort to hand pollination. It may be possible to develop hybrids with the excellent fruit of the *triloba*, and with the attractive and fragrant flowers of the southern species so that they will be attractive to insects or bees. For this purpose I am using on *triloba* the pollen of *obovata*, whose flowers are sometimes six inches in diameter, and the *reticulata* whose fragrance is equal to that of the petunia. This combination, could it be combined with a desirable fruit-type, should be irresistibly interesting to many insects.

The pistils of *Asimina* flowers are so easily injured that large insects may turn out to do more harm than good. During the operation of hand pollination with a fine camel's hair brush it is not an uncommon tragedy to find the stigma on the brush when the job is done. The stigma will not set any fruit on a camel's hair brush or on a bumble bee's legs. However, if carefully done one can in a very brief time pollinate enough flowers to give an abundance of fruit for the family table. A very little more time would be necessary to put fruit production on a commercial basis.

After a little experience pollination does not take so much time as might be expected. When the fruit ripens the time seems very well spent. Otherwise, without hand pollination failure is almost certain under any conditions. For the past two years I had more fruit from my papaw collection than ever before and all from a couple of hours' work. Two years ago there was no fruit of any value anywhere in our district other than that

which developed from that pollinated by hand. I had made a practice of allowing native trees that bore well to stand, whatever the quality of their fruits, in the hope of getting adequate pollination for the good trees. Now I am beginning to doubt whether this if of any real benefit.

Crosses With Annonas

With the *Annonas* it has been very difficult to get pollen at the right time and in sufficient quantities since it must come from Florida or California. However, I now have in the greenhouse many species growing and hope shortly to be able to produce plenty of *Annona* pollen. Last spring I pollinated flowers of the Tiedke and Long John with pollen of the *"atemoya"* hybrids and of *A. Squamosa* and had a few fruit set from each. Whether these will prove hybrids must wait the development of the plants from these seed. It is just possible that we may have to change the chromosome groups in some of these species before the ultimate goal is reached. An interesting discussion on the *Annona* will be found in the *Proceedings* of the Florida State Horticultural Society for 1939 by Dr. David Fairchild.

Since 1916 I have succeeded in going far enough in breeding papaws to realize what an immense job lies ahead. At the same time the vision of what can be accomplished has widened in proportion and I am sure that the end will certainly justify the work and the waiting. The possibilities are thrilling and there are compensations; quite soon the crosses yield handsome ornamentals, novel and interesting new creations. If the experimenter takes a little extra time to hand pollinate until better ways are found, he will be handsomely repaid with an abundance of luscious fruit.

✦

THE *HOW* AND THE *WHY* OF THE GENE

THERE are three stages in scientific enquiry: *What? How?* and *Why?* The first, a relatively easy stage, is essentially taxonomic. We go around slipping nets of observation down over facts, sticking pins through them, labelling them, and arranging the resulting symbols (which we too often mistake for the facts themselves) in naphthaline-soaked categories. We set up experimental conditions only to snatch and label the facts (and the interpretations) which emerge. Many valuable scientific contributions are of this nature.

The second stage is one involving analysis. We take the facts (or the symbols abstracted from the facts) arrange and rearrange them, treat them mathematically. In these ways we try to squeeze secrets from them, mainly of how the facts came about. We check our conclusions by making them the basis of predictions of what should happen to these facts under new experimental conditions, and then we set up those conditions. If nothing is found to conflict with our interpretation, we say we *know* how these facts were caused.

In the third stage we try to find out by examining the *What* and the *How*, just *why* our materials behave as they do. This stage, dealing with the ultimate nature of things, is the most difficult, involving atomic physics, and biochemistry—levels of factual analysis beyond the perceptions of our unaided senses. But this third stage is the goal toward which all research is oriented.

Physiological genetics represents the extension of genetic inquiry into the second and third stages,—into the *How?* and *Why?* It has grown rapidly since its origin about 1910. Richard Goldschmidt was its founder and has been its prime moving spirit. The present volume* rep-

*Goldschmidt, Richard. Physiological Genetics. Pp. 311. $3.50. McGraw-Hill Book Co., New York, 1938.

resents the current evolutionary status of the concept, as *Die quantitative Grundlage von Vererbung und Artbildung* (published in 1920) and *Physiologische Theorie der Vererbung* (1927) represent the ancestral stages in its development. The names of Wright, Zeleny, Huxley, Sturtevant and Plunkett denote a constellation of minds that helped to direct the later evolution of this concept.

Naturally, much of the material is common genetic knowledge, already touched upon in many genetic texts, because the contributions of such important researchers cannot be hidden. The most important contribution of the book, it appears to the reviewer, is the discerning selection of materials, the method of arranging them and the point of view which remains persistently physico-chemical. Professor East used to say that a great deal of rotten scientific analysis was foisted on the world because too many research workers adopt the first explanation that pops into their heads, after which they resolutely refuse to sit down and think out all the other possibilities. As a contrast to such sloppy scientific behavior one must admire the way in which Goldschmidt attacks each topic, setting down the possibilities, arguments and conclusions under numerals as 1, 2, 3, 4, 5, just like that. To substantiate his views he marshals up his battalions of experimental facts from the whole wide field of genetics. The facts pass the reviewing stand thoroughly inspected and in perfect marching order.

Contents

There are three sections styled, "The Mutated Gene and the Potentialities of Development," "The Cytoplasm and the Activation of the Gene" and "The Nature of the Gene." The sizes of these sections are 160, 19 and 35 pages, respectively. These main divisions are split up into such topics as "The Phenocopies," "The phenocopies and the development of mutants," "The mutant gene and the rate concept," "Some special types of mutant genes and gene actions," "The gene in heterozygous state," "The gene in different doses," "The interaction of the genes," "The type of reaction controlled by the mutant gene," "The problem of pattern," "Interaction of nucleus and cytoplasm," "The activation of the genes," "Cytoplasmic heredity," "The gene as an active molecule or group of molecules," "The theory of the genes as based upon physical deliberations," "The gene as an aggregate of different parts," "The gene as a loss of chromosome material," "The gene as part of a higher unit," "Outlook upon the theory of the gene of tomorrow."

The extensive bibliography contains nearly 900 titles.

There are good illustrations and clear diagrams, many of them the author's.

Physiological Genetics is not a text for College Freshmen. It is suited to special courses for Seniors, Graduate Students and Researchers.

Gene Timing

Genetic effects are conceived of as due to reactions having differential timing, oxidation, reduction, acidity, arrests, retardations, accelerations, temperature sensitivities, rates of cell division, destruction of necessary substances already produced, thresholds, thermolabile catalysts and the like. When gene meets gene, they may combine, compromise or ignore, in their efforts to construct that master marvel, a biological organism.

We do not know much about the functional relations of gene to cytoplasm, although Goldschmidt finds evidence enough to state:

"Thus we conclude that the cytoplasm is mainly the substratum for genic action, in which all those decisive processes take place which constitute development and which are steered by the genes. The specificity of the cytoplasm is therefore one of the prerequisites of orderly development, and this is tacitly assumed when the action of the genes is being discussed. The specificity of the cytoplasm probably increases with the systematic distance of the forms, and it may find expression in crossing experiments in a different result of the action of the same genes in different cytoplasm. Thus far, however, no fact is known that would force us to assume that specific hereditary traits exist that are transmitted through the cytoplasm and are individually caused by a genetic property of the

cytoplasm. The plastids of plants are probably a third independent constituent of the cell in regard to heredity."

The Chromosome-Molecule

In the last section as a result of an analysis of the facts, the gene disappears and the chromosome arises from its ashes as a complex giant molecule. Genic effects are in many, and possibly *most*, cases merely figments of the atomic rearrangement. Thus, the giant molecule is our most modern picture of the chromosome.

Goldschmidt does not claim this portrait to be original with him, but credits Castle, Renner, Koltzoff, Bergmann, Wrinch and others for having previously seen the vision.

Progress often goes in cycles—or spirals. In 1919 Castle published a demand* that the Drosophila geneticists explain how there could be more than 50 units on a chromosome map based on crossing-over percentages, if 50 per cent crossing-over represents independent segregation. He argued that this point was crucial if the linear order of the gene were to be accepted in preference to a three-dimensional space arrangement. This argument was torn to pieces by the Drosophila School, and at a time when unpublished data already on hand squarely met Castle's just demands. It may be some consolation to Castle that a "stone that the builders rejected" seems to be again incorporated into the structure of genetic concepts. In the last sentence of that paper, in speaking of crossing-over Castle said: "It is like the replacement of one chemical radicle with another within a complex organic molecule and it seems highly probable that such is its real nature." A concept which does not sound out of place in Goldschmidt's book.

CLYDE E. KEELER.
The Wistar Institute.

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Zoological Research Fellowships

The Zoological Society of San Diego announces the renewal of two research fellowships available to advanced graduate students for the pursuit of research work at the Biological Research Institute on some phase of animal biology (concerned primarily with such branches as pathology, bacteriology, parasitology, physiology, comparative anatomy, comparative biochemistry, animal nutrition, or animal psychology). The stipend of each fellowship is $1,000.00 per annum.

The Zoological Hospital and Research Institute is supported by public appropriations and endowed funds, and is devoted to problems concerned with the health and normal life of animals, in and out of captivity, and to various phases of biological research. It is operated in connection with the San Diego Zoological Gardens which house 3,000 animals, including 175 species of mammals, 500 species of birds, and 150 of reptiles.

Research facilities include a two-story building with individual laboratory and office rooms. Refrigeration, incubation, X-ray equipment, microphotographic apparatus, microtomes, microscopes, etc., are available in the building. An extensive outdoor animal isolation yard houses all new animals and research material. New animals are continually arriving from different parts of the world, often presenting special problems in nutrition and health. There is a wealth of material for pathological, parisitological and anatomical study from the zoo and other cooperating agencies.

Since the Biological Research Institute is not directly affiliated with any university, it is desirable that a recipient of a fellowship work under the department from which he applies.

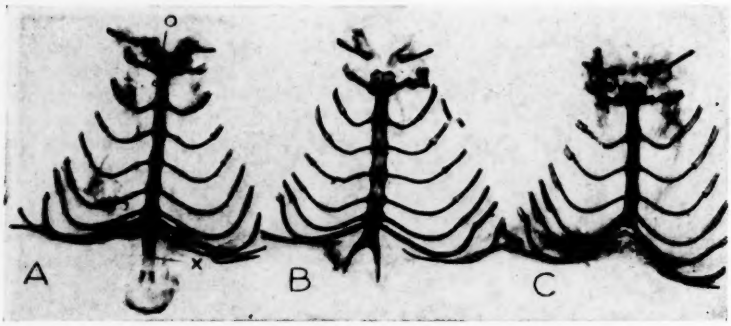
Further information will be sent upon request. Applications should be addressed to Dr. Charles R. Schroeder, Biological Research Institute, Balboa Park, San Diego, California, before May 15th, 1941.

*CASTLE, W. E., Is the Arrangement of the Genes in the Chromosomes Linear? *Proc. Nat. Acad. Sci.* 5:25-32. 1919.

BIFURCATED XIPHISTERNUM AND ITS RELATIONSHIP WITH SHORT EARS IN THE HOUSE MOUSE

E. L. GREEN* AND C. W. MCNUTT

Whitman Laboratory, University of Chicago, and Arnold Laboratory, Brown University



XIPHISTERNUMS — NORMAL AND "BIFURCATED"
Figure 6

Sternums of mice photographed from the inner aspect to show the structure of the xiphisternum. x=xiphisternum; o=omosternal elements. *A*—Normal xiphisternum in wild type; *B* and *C*—Bifurcated and reduced xiphisternums of short-eared mice. The abnormal formation seems to be another effect of the "short-ear" gene. (×2.)

THE posterior element of the breast bone or sternum of the house house is typically a long rectangular bone surrounded by cartilage (Figure 6*A*). Another formation of this xiphisternum in a stock of short-eared mice has been referred to by Strong,[1] and has later been found by us in three other stocks of short-eared mice This aberrant type shows considerable variation in form but is unmistakably different from the normal xiphoid process. In different individuals it may be symmetrically bifurcated (Figure 6*B*), or one ramus or both of a supposed bifurcated type may be imperfectly developed, or the entire process may be reduced in size to practical absence (6*C*). Fusion of the terminal two or three sternal elements is common in the more extreme cases of reduction. Because of the great variation, a detailed classification of the abnormal types is virtually impossible. The term "bifurcated" seems to be the most descriptive. Within the short-eared stocks, the individuals of the *N* and *G* stocks tend toward the symmetrical bifurcation, those of the *P* stock toward extreme reduction.

It may also be noted in the short-eared animals shown in the figure that the omosternal elements either are not ossified or are absent. These elements are normally not visible in young mice, and since only breeding animals of the short-eared stocks have been raised to

*Corinna Borden Keen Research Fellow of Brown University, 1940-41.

maturity, it is not possible to say that these elements never ossify in short-eared mice, although none has yet been found.

Matings

Reciprocal matings were made between members of a normal ear, normal xiphoid stock (C3H, wild type) and members of the three short-ear, "bifurcated" xiphoid stocks. The *N* stock differs from the wild type by non-agouti, brown, chinchilla, pink eye, blue dilution (*abc*^{ch}*dp*); the *P* stock is the same except that color replaces chinchilla (*abdp*); the *G* stock is composed of two groups, one non-agouti (*a*), the other brown dilute (*bd*). Dilution and short-ear, which are closely linked,[2] entered all matings on the same chromosome, except for a few matings with dense short-eared mice of the non-agouti group of the *G* stock.

The results in Table I show that in every generation there is a perfect association between normal ear and normal xiphoid, and between short-ear and "bifurcated" xiphoid. The other combinations, normal ear with "bifurcated" xiphoid and short-ear with normal xiphoid, were not found among the segregating progeny of the F_2 and backcross generations.

With respect to dilution and short-ear, a single crossover occurred in the P(*P* × *C3H*) mating.

$$F_1\,♀\ \frac{++}{d\ s^e} \times P\,♂\ \frac{d\ s^e}{d\ s^e} \rightarrow ♀\ \frac{+s^e}{d\ s^e}.$$

This short-eared dense female had a typical bifurcated xiphisternum.

Offspring from a few preliminary matings between the *N* and *P* stocks all had "bifurcated" xiphisternums, although in conformation the sternums tend to resemble those of the *N* stock. It is probable, but not established, that the difference between the xiphisternums of these two short-ear stocks is caused by the different genetic background against which the "short-ear" genes operate in each stock.

One or Two Genes?

Consideration of two sorts of evidence indicates that the "short-ear" gene itself is responsible for the bifurcation of the xiphoid process.

(1) In view of the fact that no crossing over has yet been detected between bifurcated xiphisternum and short ear, and that they behave as a unit in the single instance of crossing over with dilution, the simplest possible interpretation is that bifurcated xiphisternum and short ears are determined not by two genes, but by one.

(2) The "short-ear" gene is known to be responsible for characteristics other than reduction in ear length. Decreased vigor,[3] changes in dimensions of cranial bones,[2] possibly a neuromuscular kinkiness of the tail,[2] and a smaller body size[4,5] appear to characterize short-eared mice independently of the rest of their genetic composition. The simplest possible interpretation of these structural and physiological changes (on the basis of the rate concept of gene action) appears to be that the s^e gene somehow alters the embryonic processes, probably early in development, thereby causing both generalized and localized retardations which become apparent at later growth stages. The effect upon the xiphisternum can be interpreted in the same manner. The sternum develops as two lateral bands of cartilage which later fuse medially and in which ossification centers appear.[6] The various types of abnormal xiphoid processes, here called "bifurcated," may be the result of devel-

TABLE I. Results of crosses between a normal ear, normal xiphoid stock and three short-ear, bifurcated xiphoid stocks.

Matings*	Normal ear, Normal xiphoid	Short ear, Bifurcated xiphoid	
C3H stock	120	-	
N stock	-	99	
P stock	-	152	
G stock	-	176	
Total short-ear		427	
N x C3H	151	-	
P x C3H	15	-	
G x C3H	60	-	
Total F_1	226		
$(N \times C3H)^2$	141	32	
$(P \times C3H)^2$	37	14	
$(G \times C3H)^2$	141	47	
Total F_2	319	93	$X^2 = 1.29$
Expected 3:1	309.0	103.0	$P = 25\%$
N(N x C3H)	190	178	
P(P x C3H)	53	63	
G(G x C3H)	36	25	
Total backcross	279	266	$^*X^2 = 0.31$
Expected 1:1	272.5	272.5	$P = 60\%$
N x P	-	42	

*We are indebted to Dr. L. C. Strong for parent mice of the C3H stock, to the Roscoe B. Jackson Memorial Laboratory for the P stock, and to Dr. W. H. Gates for the G stock.

opmental arrest at a critical period, or of a disharmony between the time of fusion of the cartilage bands and the onset of ossification within them. The listing of bifurcated xiphisternum among the effects of the s^e gene requires no new behavior for this gene beyond that already imputed to it.

Summary

In the mouse, aberrant formations of the xiphoid process of the sternum, termed "bifurcated," are believed to be an effect of the same gene which determines short-ears, because the two characteristics always occur together in segregating generations of crosses with a normal stock, and because the "short-ear" gene is known to be associated in some way with other structural and physiological abnormalities of the skull, body, and tail.

Literature Cited

1. Strong, L. C. Two new structural characters in mice. *Anat. Rec.* 58: Suppl. 1, p. 88. 1934.

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4. Castle, W. E., W. H. Gates, S. C. Reed, and L. W. Law. Studies of a size cross in mice II. *Genetics* 21:310-323. 1936.

5. Law, L. W. Studies on size inheritance in mice. *Genetics* 23:399-422. 1938.

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A SYMPOSIUM ON GENES AND CHROMOSOMES

The Biological Laboratory, Long Island Biological Association, Cold Spring Harbor, L. I., N. Y., June 18th to July 2nd, 1941

As part of its policy of fostering a closer relation between biology and the basic sciences, the Laboratory invites each summer a group actively interested in a specific aspect of quantitative biology, or in methods and theories applicable to it, to carry on their work and to take part in a Symposium at the Laboratory. The aim is that every important aspect of a given subject should be adequately represented, from the physical and chemical, as well as from the biological point of view.

The Symposium this year will deal with genes and chromosomes. As a rule the participants will be in residence at Cold Spring Harbor during all of the two weeks' period.

Investigators interested may attend and take part in the discussion of papers without further invitation. Persons coming from a distance should make certain that there has been no change in the program. Arrangements for rooms and meals should be made in advance.

Each day's program begins at 9:30 A. M. When three papers are scheduled for the same day, the third one will be read at 2:15 P. M.

Structure of Chromosomes as Revealed By Optical Methods

Wednesday, June 18th

Warmke, H. E. External morphology of chromosomes

Nebel, B. R. Structure of plant chromosomes, with particular emphasis on the number of chromonemata.

Huskins, C. Leonard. The coiling of chromonemata.

Thursday, June 19th

Berger, C. A. Multiple chromosome complexes in animals and polysomaty in plants.

Salivary Gland Chromosomes

Metz, C. W. Structure of salivary gland chromosomes.

Mazia, Daniel. Enzymatic studies of chromosomes.

Friday, June 20th

Painter, T. S. Chemical studies of chromosomes.

Schultz, Jack. The evidence of the nucleoprotein nature of the genes.

Cole, P., and Sutton, E. Variation in the absorption of ultraviolet irradiation by the bands of salivary gland chromosomes.

Spontaneous and Induced Changes in Chromosome Structure

Saturday, June 21st

McClintock, Barbara. Spontaneous alterations in chromosome size and form in Zea.

Kaufmann, B. P. Induced chromosomal breaks in Drosophila.

Monday, June 23rd

Sax, Karl. Effect of irradiation on plant chromosomes.

Carlson, J. Gordon. Effects of irradiation on grasshopper chromosomes.

Fano, U. On the analysis and interpretation of chromosomal changes in Drosophila.

(Continued on page 112)

QUALITY OF POPULATION AS NECESSARY FOR NATIONAL DEFENSE*

E. J. Coil

Director, National Economic and Social Planning Association

WE, in the United States have no need to worry at present about the sheer numbers of men available for our defense. Over 16,300,000 men, age 21 to 35 inclusive, registered in the continental United States alone last fall. In addition to these, there are about 3,560,000 of the age 18 to 20. If only one-fourth of these men were considered available for military service, this country would have, if it so desired, an army of 5,000,000.

But even an army of this size does not seem warranted. I am not competent to express a judgment as to the precise size and composition of our armed forces. That task belongs to those who are professionally responsible for our foreign policy and for our protection. From what these persons have said, however, and from what has and is happening abroad, it does seem that our military requirements do not run in terms of millions and millions of massed men. Rather, war strategy today centers about planes and ships, tanks and guns; about flexibility, speed, and power; in short, about the skilled direction and operation of machines. Prime Minister Churchill has said in reference to the role of the Royal Air Force that seldom have so many owed so much to so few. In other words, seldom have millions depended so completely on the quality of their defenses, the quality of their men and of their machines.

We in this country have ample grounds to be concerned, vitally concerned, about the quality of our population. Our population, we must remember, not only is the reservoir from which those who are to defend us must be drawn, but also is the people which are defended, and which, in a democracy, resolve that they are worth defending.

To date, the Selective Service Commission does not have complete figures on rejections in the first draft call. On the basis of reports from some of the local boards and on the experience of the last war, a few observations can be made. In the World War draft of 1917-18, 52 per cent of the persons called had one or more recorded physical defects, and 31 per cent were classified, on physical grounds, as not available for general military service. The most frequently occurring conditions responsible for rejection were defective vision, underweight, tuberculosis, defective teeth, hernia, and venereal diseases. We must keep in mind that these defects are, in the main, remediable ones. One generation later, that is today, the rejections at the local boards are about the same as in the last war. Of course, we will not know the full story until all returns are in from the local boards, but from the available reports it seems that our man-power has not improved physically since the days of 1917-18.

Democracy Needs Total Well-Being

This does not mean that there will be any lack of able-bodied young men to meet all the requirements of the armed forces. This fact may satisfy some individuals; but it cannot satisfy the American people concerned with defense. We must remember that the character and the issues of this war are different from what they were last time. Our concern does not stop with the quality of the armed forces alone. Under total war, the condition and well-being of our industrial workers is as important as the health of our soldiers. An expanding flow of war equipment depends on the quality of our workers. But even more, this is a war in which the maintenance of

*Presented at the Annual Meeting of the Birth Control Federation of America, January, 1941.

democracy is *the* issue. If democracy is to justify itself, it must do so on the basis of the well-being of its people. We today, dare not be content to consider the present quality of the American people as sufficient justification of democracy.

We must plan and act now to improve that quality, both in the interest of our present defense and in the interest of our future. This clearly is not a time for putting off thinking about tomorrow until we see what happens during the war. Although at the end of the last war we knew that 52 per cent of our drafted men had physical defects, we were content to let a new generation grow without any marked improvement. We were not prepared and determined to make that new generation a better one. This time we must not fail; we must do now the planning, and work so that we can make things as we want them to be.

A Positive Health Policy

Many aspects of our life are involved in this planning. Today I wish to make a few remarks regarding the future quality of our people from the principal viewpoint of health. Any population policy must begin with health, and any positive health policy must be an active driving force, helping life along. As Julian Huxley has recently observed, there are two aspects of positive health: one is the individual aspect, the other social.

One consists in being and feeling well, in having the height, weight, strength and energy that makes men glad to be alive. It also means strong and vigorous minds that enjoy mental activity as the body does physical exercise. The other aspect, the social one, is that we cannot get individual health of mind and body unless we have a social organization designed to permit it, and indeed, to promote it. Society itself must be healthy. People must not only have work, but be able to work together with a vital sense of security and opportunity. People, as a society, must have a sense of unity, of belonging, and channels of participation and expression. And again, from the social point of view, there must be enough children to keep society going.

These are general statements, to be true, but there is in the United States sufficient knowledge to translate general aims regarding the health of individuals into specific standards. It is possible not only to set up program health standards but also to measure how far any particular person or group of people falls below those standards. We have reasonably accurate medical statistics. If a state, or a county, or even a country, has a death rate above a certain level, its health services simply are bad. If its infant and maternal mortality is above a certain figure, it is not taking adequate care of its babies and its mothers. In this country about 51 babies out of each 1,000 die before they are one year old. Yet we know from what other countries have accomplished, that there is no excuse for having an infant mortality rate above 40. Likewise, as a standard, we should not tolerate maternal mortality of over two deaths for every 1,000 births.

We have, and largely since the last war, developed the science of nutrition. We know what constitutes an adequate diet; we know how tall a group of boys and girls ought to be, and how much they should weigh at any given age. We also know to what levels the incidence of various diseases can be brought down by proper measures.

Standards of this sort can be rather accurate, and even for other vital aspects of health, the standards can be reasonably definite. Enough is known about housing to establish standards of space per person, of sanitation, of privacy. And even in the case of clothing, certain quantities and qualities of clothing and footwear, depending on the climate, are known to be essential for bodily warmth.

I do not wish to go into any detail about these. The knowledge is available, and our problem is its application. In all our efforts to improve the quality of our population we must begin with the family. Measures will be unrelated to reality unless we build our plans around the family because it is the unit of living. Of recent years increasing emphasis has been placed on the fact that a minority of families produce the majority of chil-

dren, and that the number of children per family increases as the income level declines. Roughly one-half of the people of the next generation will be produced by one-quarter of this generation.

Income and Family Size

The consequences of this situation are serious and distressing. Three children should eat three times as much as one, and yet, it is an impossibility for the unskilled worker, on his income alone, to provide the necessary food. It is almost impossible for many skilled workers to feed their families adequately on their prevailing annual incomes. Thus poverty, as we know, causes health suffering among children; and, as we too frequently do not recognize, too many children can cause poverty in a family. I do not want to be misunderstood in this matter. I am not saying that children are a cause of depression, but simply that an income sufficient to maintain health standards for a family of three will not stretch to cover a family of six.

The remedy does not lie in having family size limited by income. That is the short sighted view. Rather, the remedy lies in bringing income up to provide the necessities and to meet the standards. It is at this point that health ceases to be a medical problem and becomes a social one. Wages are not adjusted to family size and family needs, but these must be taken into account if we want healthy children. Clearly we want some form of family allowances, payable to the mother, partly in kind, and partly in cash. There certainly should be, if democracy is to prove itself richer and freer than totalitarianism, a national minimum — a standard below which no one, adult or child, should be allowed to fall.

If family endowment for food, clothing and shelter is one side of a social health policy, birth control is another. A positive policy of birth control means, as a minimum, the establishment of child welfare centers in every county and urban community in this country. And every welfare center should have its own birth-control section. These centers should become the local institution for healthy family planning.

Such measures as these recognize that individual action alone is not enough; that the world of today, and even more so of tomorrow, must rest on organized, community endeavors. It implies that public health services not only must act to prevent the spread of disease but also must take the initiative to improve well-being. It also implies major efforts for economic and social reconstruction. It means work for all. If we are to have a more healthy population, people must be freed from the overpowering anxieties that now hang over so many—the threat of unemployment, the threat of illness, the threat of not being able to give their children the start in life they should have. If we are to have a freer and a non-warlike population, we must provide creative opportunities so when work is over, outlets for expression can be found.

J. B. Priestly has written as follows: "Men and women everywhere lust for power and then use it badly simply because their creative urges were frustrated. Something that ought to have been released in good work is dammed up until it turns sour and rotten. Energy and insight that might have served the community are then turned against all its best interests. I believe strongly that creation, which may take one of a hundred different forms, can easily take the place of much power-seeking."

To improve the quality and well-being of our population should be our most positive war aim. It is not something to be put off until after the war. It is not something for our grandchildren; but for ourselves and our children. It is as essential to our defense as the production of arms. We know our objectives, and with the will of a free people these objectives can be attained.

WHENCE GIFTED CHILDREN?

THIS investigation,* the only general survey of superior children located through impartial sifting of a large school population to appear for some years, is of particular interest because of its wide geographical spread, because of a reversal in direction of sex ratio and a "humbler" occupational distribution of parents than has ordinarily been found in previous studies, and because of a comparison of "test-selected" and "teacher-selected" gifted children.

Lewis' group of subjects was composed of the upper ten per cent (i.e. subjects over 115 IQ) of each grade (between grades 4 to 8)on the Kuhlmann-Anderson test administered to over 4,500 children in 455 schools in 310 communities. Although 36 states were represented, there appeared to be no sampling system according to population density, and a rather heavy weighting occurred for some of the agricultural states such as Montana, Washington, North Dakota. Like his predecessors, Lewis found the gifted to be superior in educational achievement, in personality traits and in breadth of interests. This superiority was in general more marked for a subgroup falling into the upper two per cent (over 125 IQ) than for the group as a whole, and even more marked in a smaller group of 341 subjects selected (regardless of test scores) by asking each teacher to check the name of any pupil whom she considered to be a genius. The interesting point is made that the children selected by teachers as "geniuses" averaged five IQ points lower than the upper ten per cent group, and fourteen points lower than the upper two per cent group, yet surpassed the "test-selected" children at all grade levels in all the achievement tests employed. This result yields evidence upon a point that has long been under discussion: that groups of gifted children selected by tests administered only to children first nominated by teachers may contain a somewhat more than representative number of subjects who have made superior adjustments to the demands of school and of the social group.

It is noteworthy and rather surprising in the light of previous studies showing a preponderance of gifted boys over gifted girls that Lewis' "upper ten per cent" group was composed of girls and boys in the ratio of 144.5:100, his "upper two per cent" group in the ratio of 146.3:100, and his teacher-selected "geniuses," 116:100. In the school population sampled, the ratio of girls to boys was 100:107.5. In correspondence with the reviewer Lewis has proposed as an explanation of the disparity with such a study as Terman's that the Kuhlmann-Anderson test appears to be loaded with items favoring girls. He has pointed out, moreover, the comparability of results in Riggs'† National Intelligence test survey on 10,000 children in grades 3 to 8, which like his own study yielded a preponderance of girls in the upper range of scores. The reviewer is inclined to agree with Lewis that with sex differences in the incidence of superior ability "it will be necessary to keep an open mind on the question for some time to come." It should be appreciated, of course, that the Lewis study deals only with children of the elementary (mainly pre-pubertal) school years, and hence does not bear upon the much increased male-female ratio of gifted pupils located by Terman in secondary schools.

With regard to the parental background of his superior group, the author underlines the fact that "every occupational and socio-economic level provides an important group of gifted children" (p. 84), and rightly observes that the distribution is so wide-spread that "no individual prediction can be made with

*William Drayton Lewis. A Study of Superior Children in the Elementary School. Pp. 104. Nashville: George Peabody College for Teachers, 1940.

†*J. Genetic Psychol.* 56:211-214. 1940.

any great assurance of accuracy on the basis of the child's background." On the whole, however, the superior children do come from homes "with a higher socio-economic rating than 'average'" (p. 83), though not so high as those considered in previous studies. As compared with the Terman group recruited from California cities, the Lewis group clearly contains a more varied sampling, but in the light of the wide range of occupational backgrounds found in the Terman group (within the limits of California urban culture), it seems hardly accurate to say that the Terman study "deals with only one type of gifted children" (p. 5). A complete "sampling" would be possible, of course, only if it were drawn from all regions and all socio-economic levels by some such method as that used in a Gallup poll. But even in the absence of such a comprehensive survey, the fact that certain socio-economic or occupational groups furnish high-testing individuals far above and far below their "quotas" seems securely established.

BARBARA S. BURKS
Columbia University

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GENETICAL RESEARCH AND THE PHYSICIAN

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THE importance of enlisting in genetical research the active support of practicing physicians is emphasized in a paper in the August issue of the *Canadian Medical Association Journal*.[1] The author points out that information from genetical studies is of potential value to the medical man but that such genetical studies depend upon the medical man for collections of detailed family histories, which the country practitioner is best qualified to supply. Although genetical training is not a prerequisite for proper history-taking, medical training is essential for proper diagnosis of conditions studied. Consequently the author presents an illustrative family history for the guidance of medical men untrained in genetics, who are willing to cooperate in the necessary joint effort between physicians and geneticists.

The family history, as it appears on the usual hospital records, is seldom satisfactory for biometrical purposes. Too often occurs the phrase "family history negative." Too often are good histories invalidated by the omission of essential information which was undoubtedly available, but the research value of which went unrecognized by the doctor. The imaginary case used as an illustration includes diagnostic information gathered by medical examination of all members of the family, with particular emphasis upon the sibs, parents, and children of the proband. The patient's diagnosis, or his recollection of a physician's diagnosis of his own or his relatives' ills, has no scientific value. As an illustration of this point, see Cockayne's "Genetics of Transposition of Viscera"[2] in which 67 out of 119 cases with family histories are rejected as not being completely reliable because diagnostic information for sibs or parents is unavailable.

Other items in the family history, which the author specifically discusses, are important for their *control* value: age of onset, establishment of parenthood, consanguinity, duplication of information using several sources. Moreover, he states that the physician should make a note of the diagnostic criteria he uses in determining which members of the family are affected. The nomenclature of disease differs geographically and temporally. One man's ideas of a disease change as his experience in medicine increases. Of even more importance: pathological conditions which are practically identical for clinical purposes and which are therefore lumped under the same name, may be entirely different in their mode of inheritance. Thus Ride[3] suggests there may be two genetical types of diabetes mellitus and three gene-

tical types of night blindness. The existence of several distinct genes which produce an indistinguishable end-result is a well established principle of experimental genetics.

To facilitate the cooperation of physicians with geneticists who are familiar with the mathematical methods necessary for the analysis of complicated data, the author recommends that physicians make their cases available for analysis by publication in medical or genetical journals. He lists the names and addresses of a few, together with the address of the Bureau of Human Heredity which serves as an international clearing house for medical genetics. The names and addresses of additional journals and of medical geneticists may be learned by writing to the Bureau, and case histories may be filed there.

The author does not discuss the important statistical question of random sampling. If medical men take cognizance of this paper by treating all (cf. next paragraph) cases of a given disease in the manner indicated, rather than selecting, as heretofore, only those cases where several members of a sibship were affected, a mass of data will be available which will constitute a random sample. The physician who has been writing "family history negative" in a case of congenital heart disease (on the basis that the patient denies heart disease in his family) is expected to write, instead, the age, sex and physical condition of the parents, sibs, etc., as in the illustrative history. The physical condition must be determined by medical examination performed by an interested, competent physician.

A final point which needs further emphasis concerns environmental influence on hereditary conditions. "The hereditary factor enters into every pathological condition to some degree,"[1] just as it enters into every physiological condition. It is important to recognize that strictly objective tests and accurate records of such tests will eventually provide us with a means of earlier recognition of disease before the age or circumstance of typical clinical onset. The observation that persons with a phthisical frame frequently develop tuberculosis is a crude example of this idea. Conditions dependent upon an hereditary diathesis plus an environmental factor may not be manifested at birth, either because the environmental factor is not present or because the age of onset (itself determined probably by a combination of hereditary and environmental factors) has not been reached. Until these conditions are fulfilled, the genotypically affected person will remain phenotypically unaffected as judged by our ordinary clinical ideas of disease. (It is unsound medical practice to begin specific therapy until a clinical diagnosis can be made; hence the importance to preventive medicine of earlier recognition of affected persons.) As the result, however, of deliberate studies (for example, of glucose tolerance curves on all members of diabetic families), we may eventually recognize typical features to distinguish genotypically affected from genotypically unaffected diabetics, long before sufficient damage has occurred to provoke clinical symptoms. Consequently the author suggests that the clinician should be guided in his genetical research rather by the availability for study of members of a sibship, than by so-called "familial tendencies" of a family in his practice.

Emphasis is on the careful objective study of individual families because the author's purpose is to arouse the genetically untrained contemporary practitioners of medicine to active research in medical genetics. Other research methods which require genetical training are disregarded because they are therefore unsuitable for the present purpose, not because they are considered inferior.

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"I. Q.'s FOR SALE" -- OR ARE THEY?

A Review of the "Nature-Nurture" Battle Among the Mental Testers

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THE controversy over the power of the cultural environment to change the Intelligence Quotient is apparently far from ended, in spite of the shift from emotional argument to the cooler objectivity of scientific research which was manifested in the approach to the heredity-environment problem some fifteen years ago. At that time the largest single nature-nurture contribution was incorporated in the 27th *Yearbook* of the National Society for the Study of Education, an organization which is also responsible for this latest major research publication.*

In 1928, East and West could not quite seem to meet in the wide open spaces which lay between the many still unknown nature-nurture variables. But since that date, the geographic line-up has become East-West coastal areas *vs* Middle West. The Chicago front of nature-nurture investigators has been reinforced by Iowa, with California now supported by New York City. Caught between the tug of these opposing forces, the I.Q. seems not to have expanded much in spite of the renewed intensity of the struggle. In 1928, some 6 to 9 points of change in I.Q. was conceded to be the expectation of the statistically average child who experienced a statistically average change in the kind of home he was reared in,—a change no greater than could be found when shifting from one end of the great middle class to the other within an American population. For the child who, once in a thousand times, might make an extreme change from a very underprivileged to a very good home, a change of from 10 to 30 (most psychologists would settle for 20) points might be expected. These 1928 estimates were not seriously affected one way or the other by studies which came later, such as those of Leahy in 1935, of Newman, Freeman and Holzinger in 1937, or Shuttleworth's reworking of some of the earlier data in 1935. That is, not until Iowa began research production in a rather big way (1936-1940) when the I.Q. again began to wander, mostly upward.

This is not the place to discuss the merits and demerits of the interim studies, particularly with reference to the kind of methods and techniques of analyses which were employed, and the degree of control exercised over such complicating variables and factors, as selectivity of subjects, practice effects on retests, test standardization errors and unreliabilities of measurement, the validities of intelligence test measurements of infants and very young nursery-school children. Analyses and criticisms have by no means been lacking, and the interested reader can turn to the critiques, especially those in regard to the Iowa reports, published at different times by Simpson, McNemar, Burks, Wellman and others.

The present two-volume publication is a second earnest attempt on the part of serious-minded workers, editors and sponsors to air the whole problem, and to crystallize the accumulated knowledge that is still floating in solution, and at times apparently even disintegrating. Dr. Stoddard of Iowa was Chairman of the Society's Committee on Intelligence: Its Nature and Nurture, the personnel of which included such outstanding workers in this field as Freeman, Goodenough, L. S. Hollingworth, Jones, Terman, and Wellman. Associated contribu-

*National Society for the Study of Education, Thirty-ninth Yearbook: Intelligence: Its Nature and Nurture, Part I, Comparative and Critical Exposition, 471 p. Part II, Original Studies and Experiments, 409 p. Bloomington, Ill., Public School Publishing Company, 1940. Cloth, $3.00 each part; paper, $2.25 each part.

tors numbered over fifty. A striking feature is the inclusion also of very forthright and detailed criticism of the methods, findings and interpretations of the various contributors, one by the other. The reports are highly technical. Part I is concerned chiefly with theory, Part II with experiment and research. The books make far from easy reading. One must be fired with considerable fervor to persist through to the end of their total of 880 pages, plus appendices. One is therefore indebted to the indefatigability of the contributors who gave of their energy, professional skill and insight, as well as right good will and feeling.

The experimental studies reported for the first time in these volumes are amply supported by reviews, abstracts, and compilations of research reports which have appeared in the scientific literature since the 27th *Yearbook* was published in 1928. All the evidence is thus in hand and affords a panoramic view of what the environment may or may not be doing to the I.Q. The research approach is no longer one of attempting to discover what per cent is due to nature and what per cent to nurture, but rather what is the effect of *a change in cultural environment* on the Intelligence Quotient. This environmental change includes changes in experience at home or at school. Experimental subjects who have experienced this change are compared with "control groups" of similar subjects who have not experienced the change, and any reliable difference in results at the end of the experimental period is credited to the cultural influence. If the two groups show no reliable difference, then it can be assumed that the nurtural factor was not influential in modifying the I.Q. of the experimental group, over and above what normal environments provide for. About a dozen experimental investigations of the effect of nursery-school training *vs* non-nursery-school upon mental development are included, and from almost as many different geographic centers in the United States. Also a number of studies on the effect of later schooling or special training. Much evidence is presented on the possible effect of good foster or boarding homes, including also institutional residence, into which the experimental children were transferred at early ages. Test-retest results from infancy to adolescence—or the longitudinal study of mental development, in which the same group of children are followed from infancy or pre-school ages on—are presented; as are also new studies on parent-child and sibling resemblance in intelligence, with genetic and environmental implications. Included also are reports on the cumulative effects of socio-economic differentials on intelligence as well as follow-up studies of gifted children, and a report on developmental patterns of identical twins. Thus all the accepted ways of unraveling nature from nurture are represented.

Conclusions Contradictory

But what conclusions can be drawn from this accumulation of new studies? Taken as a whole, and assuming equal validity for all of the contributions, the answer, it must be admitted, will still lie buried in provocative confusion and contradiction. From these many presentations, one is not able to deduce with any greater finality than before that such and such a specific change in environment, for such and such a designated group, will result in so and so many points of change in I.Q. But what the reader will be able to do is to develop a keener appreciation of the hazards and fallacies inherent in nature-nurture data and their fair interpretation. From the many analyses offered here, he should be able to extract a set of criteria for evaluating a nature-nurture research study, and by applying these criteria, to accept or reject those contributions which do not meet the test, at least in the main, of his criteria. The following may be cited as illustrative:

Sampling: Are the control groups actually similar to the experimental groups in certain crucial characteristics, such as age, race, social origin, possibly also sex distribution, parental cooperation, initial ability, special experience, and other selective factors? And even if they were

similar to begin with, what change (other than the experimental variable itself) may have been introduced in the interim, or by the progressive elimination of certain subjects over a period of years?

Validity and Comparability of Tests: Are the tests which were used initially and finally equally valid and comparable? For example, "baby tests" given to infants have been shown not to correlate with results on the same children when tested several years later by a well standardized test. Tests given to children under five years of age, using both the Kuhlmann and the Stanford-Binets, first editions, awarded I.Q.'s that were somewhat too high; while the old Stanford-Binet, when administered to individuals over 14 years of age, yielded I.Q.'s that were somewhat too low. These errors in standardization have been corrected in recent revisions and should not be such serious sources of error in future investigations in which the newer forms are used. But the reader must be on guard to note which revision is referred to. It can be deduced, even by the relatively uninitiated, that adolescent mothers who got depressed I.Q.'s on the old Stanford-Binet, and their babies or toddlers who got somewhat elevated I.Q.'s, will *seem* to resemble one another less than will older children, tested between ages 5 and 14, who are compared with adults, possibly foster parents, also tested with more valid measures for adult intelligence.

Reliability of Conditions of Testing: Young children are apt to be negative, timid and shy in a strange situation. Unwed mothers, committed to custodial care, and tested soon after admission, are also in an emotionally tense situation. Best results by way of rapport, cooperation and test effort can scarcely be assumed for either circumstance, and conclusions based on such procedure must be of doubtful validity. Children tested under normal home or school conditions will more nearly reflect their true ability. The skill of examiners in eliciting test responses will vary with their competence, tact, training and experience. The appearance of many different examiners in any one research may operate to confuse the issue of whether an ascertained change in average I.Q. is a true change, or merely a reflection of change in test conditions, including differential professional skill of examiners.

Reliability of Tests and Test Scoring: The more technical aspects of whether or not to score certain "marginal" responses as successes or failures cannot be discussed here, but the problem is a commonplace with experienced examiners. These doubtful answers, and the variable kinds of material to be found in the content of tests at widely separated age levels,—not to mention practice effects with the reappearance of the same or similar test items—renders mental measurements less reliable than the more strictly physical measures such as a foot-rule. While the ratio of mental to chronological age may be pretty much of a constant, the actual measuring of this ratio (i.e. the I.Q.) will be less so. Some tests are much more reliable as measures than others are, and the reader should be somewhat sophisticated on this point, when he interprets comparative test data.

Length of Experimental Period: Were the children studied for an adequate length of time? In foster child studies, were the subjects placed as infants, before early environmental influences had an opportunity to leave permanent effects, and were the children followed thereafter for at least six years? Measuring change over short periods, often no longer than a few months, may introduce purely chance results.

Statistics Used to Measure Change: The validity of the ascertained gain or loss will be a function of the validity and reliability of the measures used in the different testings, and also of the variables in the testing conditions. But above these, allowances should also be made for such statistical tendencies as regression toward the mean. Formulae have been devised for this purpose, but

this does not imply that they are necessarily used by the different investigators. The particular statistical techniques employed in any study to measure change or resemblance or difference should be understandingly scrutinized for their suitability to the particular data in question. Much heat and little light have been engendered from the wrong selection of statistical devices, or the use of wrong statistical formulae.

Unbiased Hearing Essential

The enlightened reader, armed with these and other precautionary perspectives, will approach the array of studies in the 39th *Yearbook*, less secure in his expectation of finding final answers, but better able to differentiate between the inconsistent answers given. He should allow the hereditarians as well as the environmentalists a fair and unbiased hearing not only as to research conclusions, but also as to their respective critical analyses of the other fellow's use of statistics and selection of subjects. He should shed his pre-held biases, if any, on the controversy, and not be guided by geographic persuasion. If like the present reviewer (who has spent half her life on the West Coast and the other half on the East Coast, with no residence in the Middle West) he emerges more deeply adherent to the coastal point of view—namely that environmental influences are no more powerful in 1940 than they were in 1928 to boost the I.Q. beyond the limits set by original nature (given normal opportunities for mental development), it will not be a dogged expression of loyalty to regions that could not do for their citizens what Iowa was apparently able to do for its children; nor will it be an expression of personal or scientific bias, but rather a carefully weighed conclusion, deduced from an inspection of the evidence, with most of the relevant and irrelevant factors controlled.

Iowa Evidence Unconvincing

The most sensational of the Iowa claims, such as the one that feebleminded children (diagnosed so at 17 months) can be made over into normal-minded when given into the care of moron nursemaids, or that children of feebleminded mothers, if placed early in good foster homes, can develop above-average ability, easily drop out of the controversy as evidence. Sixteen cases are not enough on which to base a generalization; old Stanford-Binet tests at the adult levels would rate the unmarried mothers too low; tests given to pre-school children,—aged in this case two years six months at testing,—would rate their babies too high. Also in good professional child-placement work in America, unpromising babies are not offered for adoption, thus pointing to a selected group in the sampling. At an average age of six, the average I.Q. of the children had dropped to 107.6, which reflects a regression to the mean, or a change toward greater reliability of the testing; incidentally also, it removes the children from superior to average classification! The expressed implication is that physically normal offspring of feebleminded mothers can be placed early in adoptive homes without risk. This suggestion contradicts the crystallization of years of experience in social work. Well authenticated cases in which this procedure has resulted in tragedy are far too common in the experience of placement agencies to leave the sophisticated reader anything but cold to an approach which seems to urge a repetition of the mistakes of the past.

If the feebleminded mothers were themselves victims of accident or serious environmental deprivation, it is conceivable that their low I.Q.'s had little genetic bases in fact. In which event, their genes would be unaffected by the deprivation and a sound potential for normality could be transmitted to their offspring. Development is dependent upon nurtural influence; no one disputes this. The Iowa mothers may have been potentially normal, and *ipso facto*, the hereditarian would be the last to express surprise that their children should turn out normal. Unless one can establish the genetic basis of feeblemindedness in the mothers, one cannot very well use them

as material for nature-nurture argumentation. All the relevant genealogical and developmental data on mothers and forebears should be presented.

The census data on gifted children undertaken by Hollingworth in New York and Terman on the Pacific Coast in regard to sex, ethnic stock, socio-economic status, quality criteria of family and relatives, etc., afford a reliable foundation for deduction as to the genetic quality. While the manifestation of superior achievement is proof enough of the correlative existence of superior capacity, its absence is not necessarily proof of the non-existence of the high capacity or even its potential. The burden of establishing genetic inferiority will rest with the investigator who assumes it.

Results of nature-nurture investigations have much more than academic interest: new discoveries and conclusions, if established, will cast more than shadows on educational and social services. They can in fact lead to a revolution in practice. That is why the research in this field must go on in spite of the tremendous amount of time, money and critical understanding required. As our measures, techniques of analysis, and scientific insight accrue, more finality can be expected in the answers which emerge. Today we are not able to answer some of the questions as originally stated; but we do have answers for relevant questions. One is that wide individual differences still persist in spite of the most enriched environment. Another is that previous mental tests given to children under school age have little predictive power. Recent revisions of both the Stanford and Kuhlmann Binet tests are much more promising, and already show positive improvement. We know also that future investigations must be experimentally designed and the variables more rigorously controlled preceding the event of adoption, special schooling, or whatever environmental experience is being investigated. Already definitions, concepts and technical approaches have been rather sharply delineated, and statisticians have given serious attention to valid methods of analyzing and interpreting data. The crucial question for the future seems to narrow down to one of the stability or permanence of improvement in I.Q., when obtained, and its expression in life achievement. On this point, nearly three decades of mental test usage will be available. Children tested before 1920 are now approaching or are already in their middle ages. Forthcoming contributions in the 1940's should be revealing, not only with respect to gifted children but also for those who have average mental endowment.

EUROPEAN POPULATION POLICIES

THE cessation of population growth in some countries and the prospect of decline in others has aroused vigorous governmental response, particularly in those lands where the abrasive influences of historical conflict and geographical proximity have rubbed raw the consciousness of national rivalries. Though the general objective of national policies has been the promotion of population increase, the enactment of numerous specific measures, often of a complex and technical nature, has rendered difficult an appraisal of these efforts.

This task has been undertaken for the general reader in a new book by D. V. Glass. The volume follows the pattern of Glass' *The Struggle for Population,* published in 1936, but is more comprehensive and brings the discussion up to mid-1939.

The book summarizes the work of the author as Research Secretary of the Population Investigation Committee, with the objective of providing a gen-

GLASS, D. V. *Population: Policies and Movements in Europe.* Oxford University Press, 1940. 490 pp. $6.00.

eral background which might prove helpful in determining future English policy. To this end Glass includes a discussion of the demographic position of England and Wales, with estimates of future population and their implications for social and economic welfare. However, the major portion of the book is devoted to chapters on national policies in France and Belgium, Italy, Germany, and Scandinavia (especially Sweden).

The policies of France, Italy and Germany are alike in their reliance on pronatalist propaganda, on repressive measures to discourage controlled fertility, and on cash and other allowances subsidizing child-birth and child-rearing. "In these countries the governments have tried as much to coerce people into having children as to create an environment in which they would be willing to have them." (p. 318)

In contrast to the "intuitive analysis" that guided the policies of these countries, Sweden has formulated a comprehensive program utilizing the enlightened research of a specially appointed population commission. This program is based on the premise that parenthood should be voluntary and encouraged, not by repression of fertility control, but by improvement of the environment through assistance "in kind."

In Glass' opinion, propaganda unsupported by material measures has yielded no tangible results, confirming the common sense judgment that parenthood is rarely undertaken from purely altruistic motives (e.g., for the nation). The suppression of abortion and of the distribution of contraceptives has not been conspicuously successful except in Germany, where the anti-abortion law is apparently rigorously enforced. Most significant of all, and this generalization applies to Sweden as well as to other countries, economic inducements to child-bearing have thus far been unsuccessful, probably because they have not been sufficiently large to cover the additional expenses of family life. "However urgently governments may have declared their desire to increase the supply of births, they have nevertheless persistently tried to buy babies at bargain prices."

However, the author feels that the comparative successes achieved in Germany are related to material measures rather than to "psychic" changes. A logical conclusion, which Glass does not explicitly state, is that an integrated attack on the problem, with the many-sided controls at the effective command of a well-organized totalitarian state, can achieve success with measures which, applied independently, are quite ineffective. This success can be achieved only at the sacrifice of the individual, a price that democracies are likely to consider too high.

According to Glass, if population policy is to aim at social and economic welfare rather than political aggrandizement, it must eschew the "futile and barbarous," though cheap, methods of repressive legislation. The alternative is a very considerable redistribution of income and probably a "direct overhaul of the social and economic structure." The author points out that perhaps, before actual population decline occurs, "society may become convinced that it is worth while to spend almost as much in maintaining the population as in promoting its extinction by unnatural causes"

Though it presumably was not undertaken with that intention, this work serves admirably as a summary of European population policies prior to the outbreak of war. As such, it constitutes a distinct contribution to population study. The book is unusually well documented, and there is an extended appendix for those interested in the more technical aspects of population measurements.

Eugenists will note that qualitative considerations are almost completely absent from Glass' discussion of policy. This omission may be attributed in part to the necessity of placing limits to an investigation. At the same time it reflects the lack of attention given by the nations themselves to this fundamental aspect of a well-rounded population policy.

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THE TRANSMISSION OF CIVILIZED TRAITS

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NEITHER eugenics nor "euthenics" can thrive best in isolation. The total eugenic-euthenic complex must be treated as a unit to get best results. We have failed to realize that cultural excellence may require as long a period for its development, and may be as difficult to replace when it is lost, as is genetic inheritance.

The frequent occurrence of varying degrees of inherited feeblemindedness provides striking and conclusive evidence of the essential part which inborn intellectual capacity plays in normal human life. Ordinary life does not provide us with similar control cases for indicating the essential nature of our cultural inheritance. Because of the almost universal permeation of human society by the cultural inheritance we almost never have a case which discloses to us what uneducated human nature would be like. As a result we confuse cultural inheritance with genetic inheritance, and often ascribe to the latter what in reality is due to the former.

Not one person in millions ever has seen a case of human nature which is not greatly conditioned by the cultural inheritance, except, of course, in case of newly born infants. Dr. Arnold Gesell of Yale recently has reviewed a description by Dr. Zingg, anthropologist of Denver University, of an Indian girl who, from the age of six months until the age of eight years, had no contact with human culture, having been brought up in a den of wolves.

It is rare that so unusual a case could be verified by competent authorities. At the age of eight this girl could not stand erect, but ran on all fours. She did not take food with her hands, but moved her mouth to the food. She lapped water like a wolf, hung out her tongue when hot or fatigued, as wolves do, and howled as they do. She made no human sounds. Even though some may express doubts of the validity of these stories, they do dramatize, not inaccurately perhaps, the basic importance of the cultural inheritance.

The "wolf-girl" was not completely uneducated, for she had the advantage of a cultural inheritance — though a much more limited pattern — of wolf culture. Left to her own raw human nature, and without that inherited culture, she would have died. It might be said that the human species as such began when the genetic control of habit became so loosened, weakened or generalized that habit to an unprecedented degree could be controlled by education and experience, rather than by the physical inheritance commonly called instinct. No other creature is so dependent as is man upon education for the determination of his living habits.

All this is obvious to anyone interested in genetics or eugenics, but some seemingly obvious inferences from it have been commonly overlooked. More and more it is coming to be realized that great differences in the level and quality of civilization may be due to variations in cultural inheritance, rather than in genetic quality. For instance, we can follow leadership in medicine through the ages from Egypt through Mesopotamia, to Greece, Rome, back to Southwestern Asia, to the Italian cities, to France, to Germany and Austria, and perhaps to the United States. It seems improbable that genetic superiority has changed its locus so frequently through the centuries. In America today we find brilliant and able physicians from racial stocks whose culture at home is on a relatively low level. Their superiority to their brothers who remained at home is due, not to a superior genetic inheritance, but to their coming into possession of a higher cultural inheritance in that field.

The cultural inheritance which most deserves to be called civilization is not first of all our technology, our law, our art and literature, our formal religion, or even our science. Underlying all of these are certain basic attitudes and habit pat-

terns. Among such basic attitudes are integrity in human relationships, so that our motives and attitudes can be counted on to be what they seem; good will in relationships, courtesy, fair play, courage, open mindedness, tolerance, patience. The list might be extended.

A people whose cultural inheritance is dominated by these and similar habit patterns is civilized, and its culture in time will flower in art, literature, religion, science, technology and industry. If these basic cultural patterns disappear for any reason, then no matter how elaborate a culture may have been evolved in art, science, literature, government and industry, that superstructure will break down.

Basic Cultural Patterns

For the most part the culture patterns which go by the name civilization are characterized by the attitude of seeing one's self, not as having worth independently of other individuals, but in relation to others. This attitude is not the same as gregariousness. Domesticated sheep prefer to live in flocks, rather than in isolation, yet when a flock of sheep is in danger, as when attacked by dogs, it is each sheep for itself. It may be that a partially instinctive habit-pattern has been lost in domestication. It would take more than Shropshire or Southdown attitudes to produce the code of "women and children first" in time of danger, or that the captain is the last man to leave the sinking ship.

Now, there are very definite conditions necessary for the preservation and transmission of these underlying traits of civilization. We can describe them by comparing them to the conditions of biological development. In most low forms of life there is no period of infancy during which the young are cared for by their parents. The higher we get in the scale of animal life the more definitely is there a period of infancy during which the offspring are cared for by the parents or guardians. This condition is frequent among insects, and almost universal among birds and mammals. In general, the higher the form, the greater the portion of its life is in this period of infancy when it cannot care for itself. Man has a longer period of infancy than any other animal, and civilized men a much longer period than primitive peoples.

The habit patterns which are the distinguishing characteristics of civilization are peculiarly dependent upon shelter and protection during the infancy of their development. The most dominant common element of these civilized traits, as has been stated, is that they lead one to determine his action, not by his sole individual interest, but by the interest of the group. By and large, an immature person acquires his life attitudes and his habit patterns by example and imitation. Only in an environment where civilized traits are the dominant pattern does one generally acquire them by imitation. Moreover, especially during the period of childhood immaturity, one cannot disarm himself to the extent of acting in the general interest unless he meets with the same attitude in others. In an environment where every one grabs for the best, the lone person who does not do so is at a disadvantage. If everyone else is active for the general good, then the immature child learns that it is safe for him to be so, and he need not center his attention on an attitude of suspicion, antagonism, and self-protection.

If a person during childhood has been in an environment in which he dare act by civilized motives, then as he approaches maturity, a process of weaning and tempering takes place, until one has the stamina and the experience to maintain these civilized habit patterns in every day business or public life; but the period of protective shelter is essential.

The rough and tumble contacts of general life do not provide the shelter and the friendly protection which are necessary in order for these distinctly human traits to become established. Such protection is afforded chiefly by the home and the local community, supplemented in varying degrees by school, church and other associations. Moreover, those basic traits of civilization are acquired, chiefly by imitation, at an early age before re-

flective thinking has greatly developed. Occasionally, but only rarely, are the fundamental cultural drives greatly modified during later years.

The great differences in cultural excellence which everywhere are in evidence are chiefly due to differences in the cultural inheritance of families and of small communities. Sometimes a great teacher or a minister or a great friend or a great book may substantially change those early acquired fundamental habit patterns after adolescence, but only rarely does that occur, and usually a foundation of quality already exists. It follows that the continuation of families and of communities with excellent cultural inheritance is an issue of primary importance to enduring social welfare.

Cultural traits are of very slow growth. A simple habit of courtesy, which one seems to come by so naturally, may have been in process of development through thousands of years. Once completely cut off, other thousands of years might be necessary for its reestablishment. In this respect genetic and cultural inheritance are alike—a species in equilibrium with its environment represents a slow culmination. As a matter of fact, a human species requires as part of this equilibrium not only genetic inheritance but cultural inheritance as well. The two can hardly be divorced.

Genetic vs. Cultural Inheritance

Genetic and cultural inheritance each has advantages and disadvantages in its method of perpetuation. A valuable genetic trait may disappear from view in a hostile environment, but remain in existence as a recessive character, to reappear and reestablish itself when conditions again are favorable. A cultural trait has no such resources. Once lost from view it is totally lost, and can reappear only by a new creation or a slow evolutionary process. On the other hand, a genetic trait can increase only with increase of lineal descendants of its possessors, unless it has a new creation; whereas a cultural trait may be transmitted from person to person by infection, somewhat as a contagious disease may spread, and need not wait for lineal biological descendents.

Yet commonly the two kinds of inheritance are transmitted together. A great family tends to be great both in genetic and in cultural inheritance. To cut off a great family, therefore, is commonly to lose both kinds of excellence.

The new technological civilization is tending to dilute or to destroy the home and the community — those centers of excellence in which our best cultural inheritance has been preserved and transmitted. Vital as is the family as the most fundamental cultural unit, in general it cannot stand alone. The good family must be supported by the surrounding community if its cultural inheritance is to be fully preserved. The family is but a part of the child's total environment. If its influence is greatly diluted by that of the community and the other elements of environment, much of its excellence may be lost.

The Community as Social Unit

Since time immemorial the small community has been the chief carrier and preserver of the basic cultural inheritance. For perhaps a million years men have lived, not on isolated farms or in cities, but in small villages. Even today probably three quarters of the human race live in villages. The village or small community has been, not just an aggregation of families, but a highly integrated social organism. It has been the chief agency for defining, preserving and transmitting the cultural inheritance. It has been the source of city population, the source of economic and political leadership.

Today the small community is disappearing. In America and Europe the typical small town is no longer a community, but a small city. No longer is there generally the intimate personal acquaintance, the working together for common ends, the development of common ethical and cultural habits, which throughout history has been the function of the small community. Similarly the intimate relations of family life, by

means of which standards and habits—the cultural pattern — were preserved and transmitted, are fading away.

If we are correct in stating that qualities which peculiarly characterize civilization must have a period of infancy for every person, during which they have the protection of a friendly, sheltering environment, then the fading away of that friendly environment may have very far-reaching implications for our civilizations. Is it not of great importance that we make a critical study of the degree to which, in reality, the qualities of civilization do depend for their existence upon the sheltering environment of the home and small community?

If the community is reestablished as a basic social unit it will not be the provincial, ingrown, culturally impoverished unit which to so large a degree in the past has set the limits of social progress. It will have a vision of its full possibilities. It will achieve an open and inquiring mind. It will use all the resources of modern technical civilization, but will recapture the unity, the mutual acquaintance, the mutual confidence and the common standards of life which made the ancient community the control of basic culture.

America is becoming vaguely conscious of this great issue. In every part of the country, in small neighborhoods of people, commonly in rural areas, but also in city suburbs and in city neighborhoods, effort is being made to achieve again, and on a higher plane than in the past, those characteristics of the community under which the best of the cultural tradition may be preserved and transmitted. The number of such undertakings, and the zest and persistence with which they are being pursued, is surprising and encouraging. There is some evidence that, once a great need is clearly realized, the democratic process is not without the ability to meet it.

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Tuesday, June 24th

Delbruck, M. Biophysical analysis of chromosome behavior.

MUTATIONS

Plough, Harold H. Spontaneous mutability in Drosophila.

Rhoades, M. M. The genetic control of mutability in maize.

Wednesday, June 25th

Demerec, M. Unstable genes in Drosophila.

Muller, H. J. Induced mutations in Drosophila.

Thursday, June 26th

Stadler, L. J. Comparative studies of the genetic effects of X-rays and ultraviolet radiation.

Hollaendar, Alexander. Wavelength dependence for mutation production with special emphasis on fungi.

Gowen, John. Mutation in Drosophila, bacteria and viruses.

PHYSICAL ASPECTS AND TOOLS

Friday, June 27th

Schmitt, F. O. Birefringence and viscosity as a tool for the study of submicroscopical structures.

Zworykin, V. K. Electron microscope.

Fankuchen, I. X-ray diffraction studies of biological substances.

PROPERTIES OF GIANT MOLECULES AS RELATED TO CHROMOSOME PROBLEMS

Saturday, June 28th

Mark, H. Structure and reactivity of long chain molecules.

Fruton, Joseph S. Proteolyptic enzymes as specific agents in the formation and breakdown of proteins.

Monday, June 30th

Wrinch, Dorothy M. The native protein as a megamolecule.

Greenstein, Jessee P. Physical changes in thymonucleic acid induced by proteins, salts and ultraviolet irradiation.

Stanley, W. M., and Knight, C. A. The chemical composition of different strains of tobacco mosaic virus.

Tuesday, July 1st

Claude, Albert. Particulate components of cytoplasm.

Rothen, Alexandre. Specific properties of proteins in films.

Mirsky, A. E. Some observations on protein folding and unfolding.

Wednesday, July 2nd

Rittenberg, D. The state of the proteins animals as revealed by the use of isotopes.

CONCLUSION

Muller, H. J. Resumé and prospectives.

Debtors to Science

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All civilization, to be sure, is indebted to the men of science.

Near the top of the list of those who have benefited from science are the nation's great producers of garden seeds. At Ferry-Morse we have constantly been guided by, and made use of, the findings of research science.

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INBRED MICE

FOR RESEARCH IN EXPERIMENTAL BIOLOGY AND MEDICINE

DURING the past few years this Laboratory has completed the establishment of a number of inbred and hence genetically homogeneous strains of mice which have proven extremely valuable for research in experimental medicine and biology. The inbreeding is carried on through repeated brother times sister matings. The essential consequence of the inbreeding is that the individuals within a strain become increasingly uniform in their heredity and after twenty generations may be regarded for all practical purposes as genetically identical. The use of such material largely eliminates a common source of difficulty in biological investigations, namely, the inherent variability of the organisms ordinarily available. The uniformity of inbred strains is illustrated by the fact that tumors originating in such a strain, when transplanted, will grow in 100% of the individuals of that strain, but will grow irregularly if at all in other strains.

Careful checks are maintained on the homogeneity of the strains carried by this Laboratory. Sublines tend to develop within an inbred strain due to the accumulation of minor mutations. These are detected and where advisable eliminated through the use of appropriate tests and breeding methods.

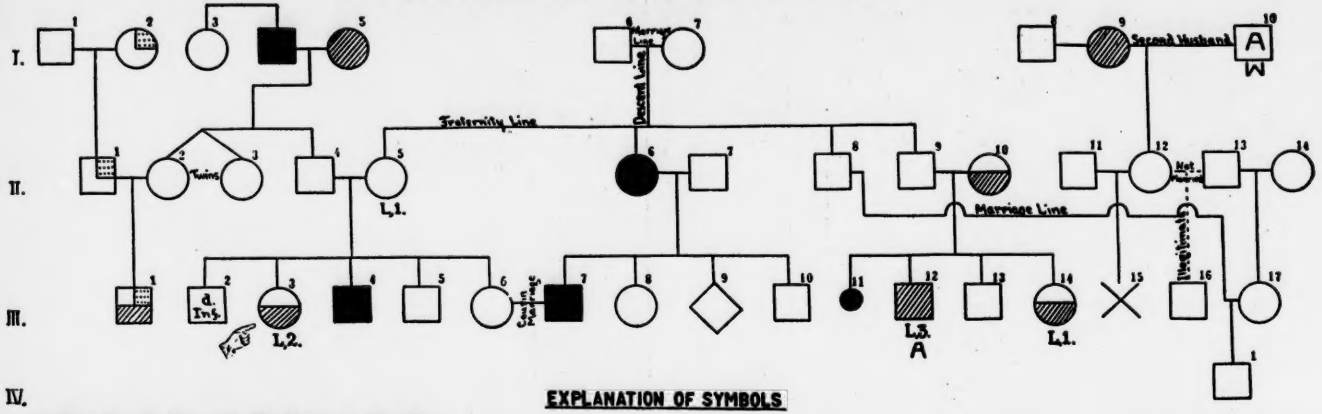
The Laboratory will welcome inquiries from scientific laboratories and hospitals concerning the inbred stock available or with regard to the possibility of providing stocks and types suitable for special experimental problems.

Supply Department

ROSCOE B. JACKSON MEMORIAL LABORATORY

Bar Harbor **Maine**

SAMPLE PEDIGREE CHART SHOWING THE MANNER OF CONSTRUCTION, AND THE USE OF STANDARD AND SPECIAL SYMBOLS.



EXPLANATION OF SYMBOLS

(a) Standard for all Pedigree Charts:

□=Male; ○=Female; ◇=Sex unknown; ●=Still-birth or Miscarriage; X=Children — number and sex unknown; ○○=Twins; d.Inf.=Died in Infancy; ☞ Points to the Propositus or central figure in the pedigree.

□—○=Parents.

□○□○○=Children.

Roman figures to the left indicate generations; Arabic figures locate individuals, (thus III.7 is the young man in the third generation who married his cousin).

The following letters, placed in or around the individual's pedigree symbol, are standard for certain traits: A, alcoholic; B, blind; D, deaf; E, epileptic, F, feebleminded, I, insane, M, migraineous, N, normal in reference to traits under consideration; Ne, neurotic; P, paralytic; Sx, sexually immoral; S, syphilitic; T, tuberculous; W, wanderer.

(b) Especially devised or selected for this particular pedigree-chart:

■ ● = Successful leaders in politics. ◱ ◷ = Extra thumb on right hand. L.1.=Highly successful author. L.3.=Little or no ability in literary efforts. ▨ ◍ = Superior in vocal music. ▨ ◍ = Medium attainment in vocal music.

To fit the particular family and traits (whether physical, mental or temperamental; good or bad) under consideration, invent special symbols, or select special letters (in addition to those standardized under (a) above) to be placed within or near the particular individual's pedigree symbol, to indicate particular traits and their degree of development.

Prepared by the International Commission of Eugenics. See *Journal of Heredity* for August 1926. Additional copies may be obtained from A.G.A.

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